CANADIAN AEROLOGICAL RESEARCH.

[*Reprinted from* Nature, London, June 29, 1916, 97: 370.]

The Meteorological Service of Canada has published an interesting account of its upper-air investigation. Part I, which is now published, deals with the records of registering balloons; the work has been done and the report prepared by Mr. Patterson, under the direction of Sir Frederick Stupart, the director. Ninety-four balloons were sent up and 53 recovered, a fair proportion, perhaps, considering the nature of the country. The instruments and methods are practically the same as in England, but the balloons have all been started at 8 p. m. local time, so as to avoid solar radiation. The mean annual temperature at each height up to 11 kilometers is very similar to that in England, the temperature fall per kilometer is almost identical, but the actual temperature is a degree or two higher. In view of the lower latitude this is not surprising; but in Canada the fall of temperature continues to a greater height than in Europe, the mean value of H_c being given as 11.7 kilometers, as against about 10.7 kilometers for Europe, and in consequence the temperature of the stratosphere is from 6 to 7 degrees (C.) colder. Except in the case of the surface pressure, the variations of all the elements are larger in Canada; the amplitude of the seasonal variation of H_c is about 2 and the standard deviation is 1.96. The correlation between H_c and the pressure at 9 kilometers (P_9) is very high, but the correlation between the surface pressure and the other quantities is very small, perhaps on account of the small variation shown by the former. The most remarkable result given is that the temperature of the stratosphere over Canada is colder in summer than in winter. The number of observations is scarcely enough to establish this with absolute certainty, but they suffice to make it almost certain, and, after all, it is no more surprising than that the lowest temperatures of the stratosphere should have been found over the Equator. The general drift of the balloons, in Canada as in Europe, is toward the east, but there are a few instances of a balloon falling westward of its starting point.

THE USE OF A FLAGPOLE IN CALIBRATING KITE ANEMOMETERS AND ALSO FOR OBSERVING AT CLOSE RANGE THE BEHAVIOR OF KITES IN THE AIR.

By B. J. SHERRY, Meteorologist in Charge.

[Dated: Drexel (via Washington, Nebr.), Nebr., June 28, 1916.]

It is the custom in calibrating kite meteorograph anemometers used by the Weather Bureau to hang the meterograph from a wind vane and compare the wind velocity as recorded by the meteorograph anemometer with that recorded by a standard Robinson anemometer. The meteorograph is hung from a wind vane in order that the ventilating tube of the meteorograph, in which the anemometer is located, will always be held in line with the direction of the wind.

When a meteorograph is in actual use it is suspended within a Hargrave-Marvin box kite, and the wind is subjected to some deflection by the planes of the kite before it reaches the meteorograph anemometer. A series of tests have been made at the Drexel aerological station of the Weather Bureau to determine, if under the same conditions, the meteorograph anemometer would record the same wind velocity suspended within the kite as when hung from a wind vane.

It was found that a kite fastened by a short line to the top of a well-exposed flagpole (see figs. 1 and 2) would fly quite steadily on most days that there was sufficient wind, and a kite fastened in this manner is held more nearly at one level than is possible if a longer line fastened to the ground is used. This arrangement also gives approximately the same conditions as a kite in the free air, so far as recording the wind velocity is concerned, and at the same time gives an opportunity to get a record of the wind velocity near the kite with a standard Robinson anemometer, placed at the same level, for comparison with the wind velocity as recorded by the meteorograph anemometer suspended within the kite.

In making these tests records were obtained on more than 50 days, but about three-fourths of them were disregarded, mostly because the wind diminished during the test. Using a Robinson anemometer as a standard and considering the mean of seven of the best tests made with the meteorograph suspended within the kite, it was found that the standard anemometer recorded 2.15 miles while the meteorograph anemometer recorded one mark; [1] considering the mean of the five best tests made with the same meteorograph hung from the wind vane, it was found that the standard anemometer recorded 2.04 miles while the meteorograph anemometer recorded one mark. By eliminating the tests during which the wind velocity fell below 16 miles an hour and considering the mean of four tests made with the meteorograph suspended within the kite it was found that the standard anemometer recorded 2.10 miles while the meteorograph anemometer recorded one mark.

The results of these tests merely indicate that, under the same wind conditions, the meteorograph anemometers will record practically the same wind velocity suspended within the box kite as they will record when hung from a wind vane. It is important, however, in making tests of this kind, that the wind vane be large enough to point true when the meteorograph is hung from it. A special wind vane was constructed for this purpose at Drexel.

In making these anemometer tests, with the meteorograph suspended within the kite, and the kite attached by means of a short line to the top of the flagpole, some useful information was obtained concerning the kites. It frequently happens that kites of the same dimensions, and that appear to be similar in every respect, will behave quite differently in the air. At Drexel, where about 40 kites are generally kept on hand, there usually have been several of these kites that would not fly satisfactorily. These defective kites would not lift the kite wire, but would usually fly sidewise, pulling down other kites attached to the same wire, and practically ruining kite flights in which they were used. Kites that had been used daily for several months, and had given excellent results, would, after being used in a high wind, sometimes become defective, and they would have to be rebuilt before they would again fly satisfactorily. Efforts had been made to locate the defects in these kites without success. It was known that with a weak stick somewhere in the framework of the kite, the strain of the wind on the sails of the kite would be sufficient to distort the kite and thus cause it to fly sidewise, but as the defect was not apparent until the kite was in the air it was difficult to locate. Any attempt to observe the kite for any length of time while it was flying near the ground usually ended with the kite diving to the ground and being smashed.

[1] The anemometer used in the kite meteorograph consists of a windmill wheel geared to a cam. The pen makes a "mark" on the record sheet for every rotation of the cam. The spacing of these marks, when the meteorograph is exposed to a given air current, indicates the speed of the current but is peculiar to the instrument. It depends not only on the gearing but also on the angle at which the blades of the windmill are set and also on the friction of the whole mechanism. While the gearing may be duplicated, the angle of set of the blades and the friction can only be duplicated within certain limits. The friction of the parts may vary somewhat with use. Therefore, each instrument must be recalibrated occasionally.—*W. R. Blair.*

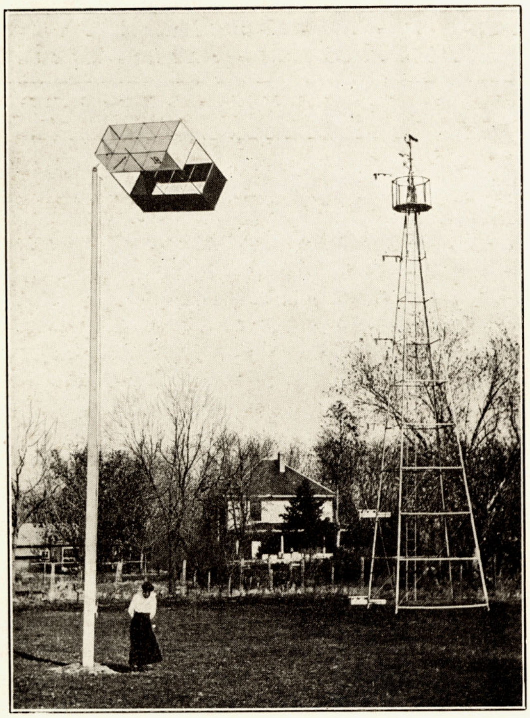

FIG. 1.—General view of flagpole with kite attached and the wind tower (anemometer tower) at Drexel, Nebr.

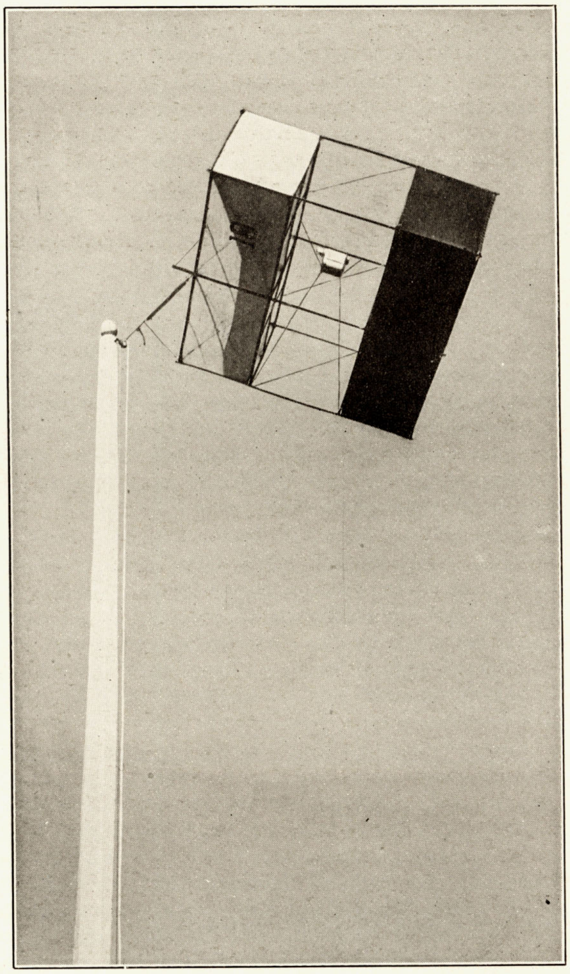

FIG. 2.—Details of attaching kite carrying the meteorograph to the flagpole during an anemometer test at Drexel, Nebr.

By attaching one of these defective kites, with a short line, to the top of a flagpole, an observer has a good opportunity to study the kite from various angles at close range, with a good prospect of detecting the defects in the kite. By using this method at Drexel it has been possible to locate the weakness in the various defective kites, and with the aid of a piece of twine to so brace these kites that they would fly entirely satisfactorily.

SOLAR VARIABILITY.[1]

By C. G. ABBOT and others.

[Author's summary.]

We have repeated at Mount Wilson, in 1913 and 1914, with improved apparatus, the determinations of the distribution of brightness along the solar diameter described in volumes 2 and 3 of the Annals of the Astrophysical Observatory. More than 40 days' determinations were secured in 1913 and more than 80 in 1914.

The results agree closely with those obtained at Washington in 1907 for all wave lengths for which a comparison is possible.

There are, however, slight but significant differences between the mean results of different years. Taking 1913 as the standard year, greater contrast of brightness between the sun's center and edge was found in 1907 and 1914 than in 1913. We incline to connect these changes with solar activity, greater contrast prevailing along with greater solar radiation at times of high solar activity.

Besides these long-period changes there appear to be small changes of contrast from day to day, correlated with the changes of the solar radiation heretofore discovered by us. For this type of changes increased contrast is associated with decreased solar radiation.

We are thus led to consider two causes of change existing in the sun. One, going with increased solar activity, we regard to be increased effective solar temperature which naturally produces increased radiation and increased contrast. The other, altering from day to day, we regard to be increased transparency of the outer solar envelopes which naturally produces increased radiation but decreased contrast.

All these changes are greater for shorter wave lengths.

---

[1] *Abbot, C. G., Fowle, F. E., & Aldrich, L. B.* On the distribution of radiation over the sun's disk and new evidences of the solar variability. Washington, 1916. 24 p. pl. 8°. (Smithsonian misc. coll., v. 66, no. 5. Publ. 2412.)